The Chimney – The Heart of the House for Ventilation, Heat, and Health

Instructions on How to Restore a Chimney to Usable Condition

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Summary of Chimney Restoration and Maintenance Techniques

Importance of Continuous Use:
Chimneys benefit from regular use to prevent moisture damage and frost damage. Installing a cap can extend the life of a chimney that is not used continuously.

Traditional vs. Modern Solutions:
Traditional methods, such as sack pulling with lime and clay mortar, help preserve the chimney's original function and appearance. Modern interventions, like installing pipes, can negatively impact both aesthetics and functionality, especially in older houses.

Rebuilding the Chimney Crown:
Proper proportions, a well-designed cap, and a traditional overhang are crucial for maintaining both the chimney's function and the building's historical character.

Common Mistakes:
Using large metal flashings and poorly designed caps can lead to aesthetic and functional issues. Documenting the original appearance and using similar materials are essential for faithful restoration.

Material List for Restoration:
Pure lime (NHL5), clay, casting sand, jute cloth, pull ropes, stove ropes, mason's string, water pipes, chimney sweep brush, garden hose, sprinkler nozzle, pressure sprayer, and a farm tank or old bathtub for cleaning.

Drying Process:
Ensure the chimney does not dry too quickly to prevent cracking. Lightly water the flue during the drying process and use plastic with small holes to regulate drying.

By following these guidelines and using traditional techniques, you can effectively restore and maintain chimneys, preserving their historical integrity and functionality.

Full article

The chimney is the heart of an old house, and it is therefore important that it functions optimally. To achieve this, both the draft for the exhaust air must be strong and the heat from the chimney must spread to the attic and the crawl space. This keeps the structures healthy because an increase in temperature by one degree reduces the relative humidity by 6%, which reduces the risk of moisture damage.

The chimney must be warmed by the residual heat from the fire, something that does not happen with modern methods such as liner pipes and heat balls. In fact, these methods often lead to the chimneys deteriorating, as moisture penetrates the lime or clay mortar and gradually breaks it down. A damp chimney also leads the heat out of the house quickly, resulting in poor thermal comfort indoors – it can feel like an “icicle” indoors. On the other hand, a functioning, used chimney provides radiant heat that contributes to a pleasant indoor climate.

In many old houses, the chimney is located in the staircase to the upper floor, and if it is not used, it often becomes very cold and uncomfortable due to the high ceiling. Therefore, it is important to preserve the chimney in its original condition. With this method, you can fill the brick joints inside the flue and restore its function. It is even possible to save chimneys where the joints are so bad that you can see right through them, but then the outside also needs to be plastered.

Taking care of the heart of the house, the chimney, is crucial to keeping the house healthy. A cap on top of the chimney is recommended because we do not burn as much as before. By preventing rainwater from penetrating, you extend the time between repairs, as one of the pictures in the instructions shows.

This method costs only a few thousand kronor in material costs to repair the entire chimney, compared to modern methods that can cost 1,500–2,000 kronor per meter and flue. Therefore, almost all chimneys should be able to be saved with this method. The problem is that many craftsmen make quick money with modern methods and can rely on the liner pipe supplier to provide the guarantee if something goes wrong during the warranty period, which is not the case if the craftsman uses traditional methods.

The instructions describe how to slide cast a chimney with clay or lime mortar using old methods, a technique often called “sack pulling” in older writings. The name can be somewhat misleading, as you do not use a sack, but a long cylinder sewn from old jute sacks. These sacks were available on construction sites as various building materials were delivered in them. I learned the method as a child when my father, who worked in Copenhagen, professionally repaired chimneys with this technique.

This method works for chimneys built around 1900 that have separate flues with dimensions of about 12 x 12 cm or 12 x 25 cm. The chimneys are usually between 8 and 10 meters high and built with clay or lime mortar. The part of the chimney that is above the roof is usually built with lime mortar, while in poorer areas, such as in Småland, clay mortar was used all the way up to the top of the crown. The last few centimeters were pointed with lime mortar to protect the clay mortar from rain.

There are many variations in the length of chimneys, but the length of the sack is adjusted depending on how long and wide the flues are. For soot vents, a similar technique is used, but here you also need to use ballast sacks filled with sand, which are lowered under the sack to stabilize it at each new stage. Otherwise, there is a risk that the mortar will fall down from the plug that the sack forms. However, this specific method for soot flues is not described here.

By using these traditional techniques, you can preserve the original function of the chimney and at the same time ensure that it continues to provide the heat and ventilation needed to keep the house healthy.

Figure 1. Picture of chimney flues 12x12 cm.

The work of restoring a chimney can be broadly described in the following steps:

1. **Preparations:**
   - Build scaffolding around the chimney to secure the work at height.
   - Lay out a tarpaulin on the roof to protect it and cover indoor surfaces near the chimney with plastic and newspapers. This is important because mortar will splash during the work.

2. **Sweeping the chimney flues:**
   Start by thoroughly sweeping all flues to remove soot and other deposits.

3. **Watering the chimney flues:**
   It is very important to moisten the flues before you start working. Gently pour some water into the flues to get the bricks damp, so that the mortar can adhere well and set properly when it dries.

4. **Coating the flues with lime slurry:**
   Use a lime slurry as the first layer. This will wash away most of the soot and provide a clean surface for the next layer. The lime slurry also helps prepare the bricks for the clay or hydraulic lime mortar to adhere properly later in the process.

5. **Let dry overnight:**
   Let the chimney flues dry overnight before continuing with the next step.

6. **Coating the flues with clay:**
   Apply a layer of clay in the flues but stop about two meters from the top of the chimney. Then coat the last two meters with lime mortar (NHL5) if the

chimney is built with lime mortar. If the entire chimney is built with lime mortar, you should only use NHL5 throughout the process.

7. **Cleaning:**
   After applying the mortar in the flues, restore and clean the areas you have worked on. It may also be good to inspect the chimney to ensure that the work is done correctly.

8. **Washing the sack:**
   If the sack has become very sooty during the work, wash it thoroughly in an old bathtub or a farm tank to be able to use it again for future work.

Protective equipment is absolutely necessary!

It is important to remember that the work involves risks that must be managed with the right protective equipment. This includes working at height, which involves a risk of falling, and working with lime, which is highly corrosive. The eyes are most at risk, but the skin can also be damaged. Lime in the eyes can lead to blindness, and if splashes hit the eyes, they must be rinsed with water for at least 15 minutes, preferably 30 minutes. Always have an eye wash bottle on hand, as rinsing within 30 seconds can prevent damage to the cornea. It is good to practice rinsing the eyes with a water hose to get used to looking into the stream. The stream should be gently flowing, which can be achieved by bending the hose to adjust the pressure. Lukewarm water neutralizes lime faster.

Working at Heights:

- Secure the ladder carefully and build a stable scaffold around the chimney.
- Always use a safety harness when working at heights.

Protection Against Lime:

- Use latex gloves, at least three layers on top of each other. This allows you to easily remove the outermost layer if you get lime splashes on your hands, to quickly wipe off splashes before rinsing with water.
- Use safety goggles and a face shield.
- Always have access to an eye wash or a PET bottle with water to immediately rinse your eyes in case of lime splashes.

Material List:

- Pure lime (NHL5), the binder, not dry mortar.
- Clay (clay from Bältabro brickworks has proven to work best).
- Casting sand (0–8 mm), purchased from a gravel pit.
- Tarpaulins to protect roof tiles from spills.
- Jute cloth (5 meters long, 1.2 meters wide).

- Light and soft pull rope (10–12 mm thick) for the jute cloth. The rope should be longer than the flues, approximately 9 meters.
- Stove rope (4 x 10 meters = 40 meters of cotton string), used as spacers between tiles to get fine and even gaps.
- A roll of mason's string.
- A coarse sewing needle.
- 6 pieces of 3/8" water pipes (1.5 meters long) with threaded couplings to attach the chimney sweep brush.
- Chimney sweep brush that can be attached to 3/8" water pipes.
- Garden hose that reaches up to the chimney and down into the flue.
- Sprinkler nozzle for the garden hose.
- Pressure sprayer to spray water down the chimney when the flues need to be moistened.
- An old bathtub or a farm tank to wash the jute cloth after cleaning.
- This list ensures you have everything needed to perform the work correctly and safely, and to restore the chimney using traditional methods.

1. Preparation

Making the Pull Sack:

- Use a jute sack cloth that is about 5 meters long and 1.2 meters wide. Place the pull rope 30 cm from the edge of the cloth. The rope should be about 12 meters long. Fold the cloth over once, then again, and once more. This ensures the rope is folded into the cloth, and the width of the cloth is now 40 cm.
- Sew the cloth along the edge with about 10 cm between stitches, resulting in approximately 50 stitches in total.
- Tie two knots in the pull rope about a hand's width apart, roughly 15 cm. These knots should be placed about 2 meters up from the end of the rope. Insert the two knots into the lower part of the sack so they are enclosed by the cloth. Wrap a cotton string (mason's string) tightly around the sack between the two knots to ensure the sack cannot slip. Wrap the string many times, tying stop knots at regular intervals to keep it in place.
- It is almost necessary to have two people for this step – one to hold the rope and sack together, and one to pull the string roll with full force.

Figure 2. The pull string is attached to the sack, and you can see the knot on the rope that prevents the sack from slipping.

Attaching the Stove Rope to the Upper Part of the Sack:

- Take a 5 mm stove rope and pull out about 10 meters, turn and go back another 10 meters. Continue with another 10 meters out and back, so you have four ropes (a total of 4 x 10 meters). Attach these ropes to the upper part of the sack in the same way as the pull rope in the lower part – wrap tightly and sew with a few stitches.
- Tie a knot every 30 centimeters on these ropes all the way, so they are connected to each other. There will be about 30 knots in total. These knots are used to determine how far to pull up the ropes during the sack pulling.

Figure 3. Attaching the pull string to the sack.

Figures 4, 5 and 6. Attaching the pull string to the sack.

Attaching the Pull String to the Sack:

- Attach a roughly 9-meter-long pull string to the string protruding from the lower part of the sack. Soak the entire sack in water.

Tarpaulin:

- Lay out a tarpaulin on the roof on both sides of the chimney. The tarpaulin should go all the way from the chimney down to the gutters. Secure the tarpaulins with clamps to the gutters. Cut a hole for the chimney in another tarpaulin and place it over the chimney to protect the roof and the surrounding area.

Scaffolding Around the Chimney:

- Build a stable scaffold around the chimney with 2"x 4" lumber. The scaffold should be built up to a platform just below the top of the chimney to provide stability and safety during the work.

Protecting Floors and Indoor Surfaces:

- Cover a walkway from the chimney hatches inside the house with plastic, so you can walk in and out with boots without dirtying the house. Also cover the areas near the soot hatches with plastic and newspapers to catch any spills and liquids that may occur during the work.

These preparations are important to ensure that the work can be carried out safely and efficiently, without causing damage to the surroundings or affecting the indoor environment of the home.

2. Execution

Day 1 – Clean and Prepare the Flues for Coating with Clay and Lime Mortar

1. Gather Protective Equipment. Collect all necessary protective equipment and ensure it is easily accessible throughout the work. This includes:

- Safety goggles
- Face shield
- Latex gloves (at least three pairs on top of each other)
- Eye wash
- PET bottle with water for quick eye rinsing
- Safety harness for working at heights

2. Sweeping: Attach a rod to the chimney sweep brush and pull the brush up and down the flue about three times. If the brush is too large, adjust it by shortening the bristles. Repeat the same procedure for the other flues in the chimney. Attach additional rods as needed and continue until all flues are thoroughly swept. Rake out the soot from the soot hatches.

3. Practice with the Pull Sack: It is important to practice pulling the sack up and down the flue before starting for real to get the technique right. Stand on top

of the chimney and hold the pull rope (main rope) over your shoulder. The release rope can also rest over your shoulder. Lower the sack all the way to the bottom of the flue. Release the release rope (stove rope) completely and pull the sack together with the main rope until it becomes tight. The more you pull on the main rope, the more the sack bunches up and fills the flue. Bend your knees and pull up the sack with your legs. Pull up the release rope one knot length, about 30 cm, and then pull the main rope until it becomes tight again. Pull up the release rope another 30 cm. If the technique is correct, it should be heavy but not extremely difficult to pull. This shows that the sack is pressing against the walls, preventing the mortar from sliding down to the bottom of the flue. Practice until you feel confident with the technique.

4. Wash and Prepare the Channels: Water the flue thoroughly so that the stones become slightly damp. This helps the mortar adhere better. Lower the sack to the bottom of the flue again.

5. Protective Equipment: Ensure you are wearing protective equipment: safety goggles, face shield, and three pairs of latex gloves on top of each other. The eye wash should be easily accessible as lime is very corrosive to both eyes and skin.

6. Mix Lime Slurry. Mix a slurry of:

- 3 parts NHL5 (pure lime)
- 1 part sand (0-8 mm casting sand)
- 6-8 parts water. The consistency should be thinner than porridge, almost like milk. This lime mixture is highly alkaline and helps dissolve the soot in the flues.

7. Prepare the Sack: Ensure the sack is tightly drawn at the bottom of the flue, which means the release rope should not be tight at all, while the main rope should be tightly pulled.

8. Apply the Lime Slurry: Stir the lime mixture thoroughly and take up half a mason's bucket (about 7-8 liters) of lime mixture to the top of the chimney. Carefully pour the lime mixture along the walls of the flue.

9. Check the Work with a Lamp: Lower a corded lamp (the type used for cars, which shines in one direction) into the flue and rotate it to inspect the walls and ensure the work is progressing correctly. Use the lamp throughout the work to monitor that the mortar is applied evenly and correctly along the flue walls.

With these steps, you clean and prepare the flues thoroughly and safely for coating with clay and lime mortar. Practicing with the sack and working with the right technique is crucial for achieving a good result.

Figure 7. This corded lamp works well.

Figure 8. Here you can see how to illuminate the sides and see how the joints have loosened.

Continue by pulling up the release rope 30 cm and then tighten with the pull rope. Each time you pull up the sack, make sure to keep an eye on the amount of lime slurry above the sack. When the amount starts to run out, refill with a few more liters of lime slurry. Usually, about two full buckets of lime slurry, which corresponds to approximately 30 liters, are needed for a normally sooty flue.

Continue to pull up the sack step by step and repeat the process until the entire flue is filled with lime slurry. The sack should be pulled up in small steps, and each time you pull, it should be heavy but not too difficult, indicating that the sack is pressing against the flue walls and the lime slurry is being evenly distributed.

When you have filled the flue and the sack is up, lower the sack to the bottom again and repeat the procedure if necessary, until you are sure the flue is clean and evenly coated with lime slurry.

Keep an eye on the flue with the help of the corded lamp, so you can see that the lime adheres properly and that no area is left uncovered. If the flue is heavily soiled, you may need to repeat the process an extra time to ensure all soot and dirt are removed and the mortar adheres correctly.

When the flue is fully coated and the slurry has been evenly distributed, let it dry before continuing with the next step in the restoration process.

Figure 9. This is what a normally sooty flue looks like.

Figure 10. After cleaning, it looks like this.

Figure 11. This is how it should look the day after the NHL 5 mortar has cured and become much whiter than the day before, with most of the soot gone.

Day 2 – Coating the Flues with Clay and Lime Mortar

To facilitate the work, it is very advantageous to have two people on the chimney and a third person on the ground who mixes the mortar and carries it up to the roof. The third person can also monitor the work from inside the house and check the soot hatches (watch your eyes!). This person can also help pull the sack down to the bottom of the flue with the pull rope when needed.

1. Mix the Clay Mortar. Mix the mortar in the following proportions:

- 1 part clay
- 3 parts casting sand (0–8 mm)
- Add water to achieve a fluid consistency – similar to buttermilk or yogurt. If you are using lime mortar (NHL5) instead, replace the clay with this binder.

2. For the Last 2 Meters of the Chimney – if you have coated the flues with clay mortar, use a lime mortar (NHL5) for the last two meters near the top. Mix the lime mortar in the same way:

- 1 part NHL5
- 3 parts casting sand (0–8 mm)
- Add water until the mortar has the same buttermilk consistency.

3. Water the Flue Walls. Water the flue walls with a pressure sprayer and let the water run down the walls. Use no more than 1–1.5 liters of water per flue, as too much water can weaken the binder in the mortar. This prepares the flue for better adhesion of the mortar.

4. Prepare the Sack. Ensure the sack is tightly drawn at the bottom of the flue. This means the release rope should not be tight at all, while the pull rope should be tightly pulled.

5. Apply the Clay Mortar. Pour about 10 liters of clay mortar (clay slurry) into the flue.

6. Tamp the Sack with Water Pipes. Assemble 3/8" water pipes (without the chimney sweep brush) so they reach all the way down to the sack. Use the pipes to tamp the sack, which helps the mortar flow around and penetrate the joints. Remove the rod after tamping.

7. Pull Up the Release Rope and Continue Coating. Pull up the release rope about 30 cm. The sack should now have moved 30 cm up the flue. You may need to lift the release rope slightly until it is possible to pull the sack up. Then pull up the pull rope and tamp again. Repeat this process, making sure to tamp after each pull to ensure the mortar spreads evenly.

8. Continue Coating Upwards. Continue in this manner until you reach about 2 meters from the top. At this point, switch from clay to lime mortar (NHL5). Make sure to stand on the chimney when pulling, and place the pull rope over your shoulder. Bend your knees and use your legs to pull up the sack. If the technique is correct, it should be heavy to pull, indicating that the sack is pressing against the flue walls and the mortar is not sliding down to the bottom.

9. Work Quickly and Carefully. It is important to work quickly to avoid the clay building up on the walls and reducing the flue's diameter. Check the flue periodically with a corded lamp to ensure everything is going correctly and no parts of the flue are left uncovered. Refill with an additional 10 liters of clay mortar as it is used up. Continue this process until the flue is fully coated with mortar. This step is crucial to ensure the flue is properly sealed and functions correctly after restoration.

Figure 12. This is how it should not look.

Lower the sack to the bottom of the flue again. Adjust the ropes and line so you can pull up the sack in one smooth motion without stopping. When you pull, it should be heavy, indicating that the sack is pressing against the flue walls and the mortar is spreading correctly. Repeat this procedure 2–4 times to ensure the flue is evenly coated and no areas are left uncovered.

If you notice that the flue has become narrow in some places due to clay buildup, lower the sack below that area again. Use a garden hose with a sprinkler nozzle to gently water the area locally. This helps to soften the clay and ensure there are no obstructions that can affect the coating process.

After softening the clay, pull the sack through the problematic area again. Check with a corded lamp to ensure the surface is smooth and there are no lumps or thick layers that can reduce the flue's diameter. Repeat as needed until the flue is completely smooth and free from obstructions.

Once you have done this and the sack pulls up evenly, you can proceed with the next step in the restoration.

Figure 13. This is acceptable, but you should run the sack several more times to smooth out any protrusions.

Final Steps for Coating the Last Two Meters of the Flues:

1. Repeat the Process for the Last Two Meters:
    - Use a mixture of lime mortar (NHL5), consisting of:
    - 1 part NHL5
    - 3 parts casting sand (0–8 mm)
    - Water, added to achieve a consistency similar to buttermilk.

This mixture should be used if you previously coated the flues with clay mortar. This step ensures that the last meters of the flue are properly covered and sealed with a durable layer of lime mortar.

2. Clean Up:
    - After the coating is complete, finish by raking out any leftover material from the soot hatches.
    - Restore all work around the chimney and ensure the area is thoroughly cleaned.
    - The jute sack used during the process should be washed thoroughly in a farm tank or an old bathtub so it can be reused for the next chimney.

Drying the Chimney After Coating with Clay:

- The chimney will dry on its own, but it is important to ensure it does not dry too quickly. If it dries too fast, the clay can crack. To prevent this, you may need to lightly water the flue during the drying process and ensure there is not too much draft in the chimney.

- To regulate the drying, you can place plastic over the top of the chimney and make a few small holes in the plastic. This allows air to slowly escape, helping to ensure the clay mortar dries at an even rate and minimizes the risk of cracking.
- If you see that the clay mortar is drying too quickly and cracking, you can lightly water the flue and pull the sack through once more. This smooths out the surface and helps eliminate any cracks that have started to form.

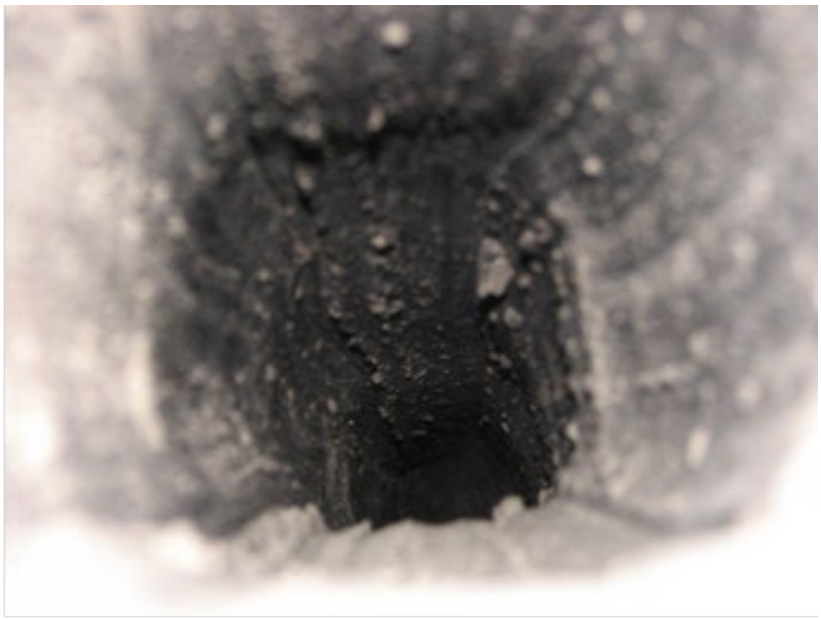

Figure 14. This is absolutely not how it should look: the flue has lost a large area and the mortar is hanging thick on the sides. You cannot see the bricks or the joints.

Figure 15. This is how it looks with some acceptable bulges.

Figure 16. The right flue is perfect; you can see the contours of the bricks. The joints are well-filled. The left one is acceptable with occasional bulges.

Chimneys

In the past, much more work and care were put into designing chimneys, and chimney masonry was an important part of the house's architecture. Skilled masons and tinsmiths placed great emphasis on both appearance and function, resulting in high-quality chimneys. The shapes often varied depending on the region and local tradition. Today, the same care is not taken in designing chimneys, as technical requirements for health and fire safety now dictate the design, leading to a more standardized and less aesthetic execution.

What to Consider When Rebuilding an Older Chimney:

Don't do it unless absolutely necessary!

In most cases, it is better to try to repair the chimney using the sack pulling method. If the chimney is in such poor condition that rebuilding seems necessary, you can often temporarily stabilize the chimney with pallet wrap around it, so it stays in place while the inside is repaired. After the inside is coated and stable, you can repoint the outside to restore the chimney's structure and appearance.

By using traditional methods like sack pulling, you can preserve both the function and aesthetic integrity of old chimneys. This maintains the house's historical character and avoids modern standard solutions that often change both the appearance and feel.

Figure 17. The picture shows the chimney before sack pulling.

Figure 18. Picture after sack pulling.

Rebuilding the Chimney Crown

When rebuilding the crown of a chimney, it is often difficult to recreate the worn, aesthetic character that the old crown had. New regulations and building codes must also be followed, which often means the chimney is built with thicker bricks and becomes taller. This can give a completely different impression than what was originally intended when the house and chimney were built, as the dimensions of the new bricks affect the entire golden ratio in the chimney's proportions.

Rebuilding the crown is both time-consuming and expensive. At the same time, a sack pulling of the crown can often be completed in half a day, excluding the repointing on the outside, which can take longer depending on the mason's skill. Sack pulling allows much of the original construction to be preserved without having to follow modern standards that can alter the appearance.

A smart trick to avoid spills on the bricks during the work is to mix clay and water and apply this to the bricks before starting. This way, mortar splashes stick to the clay layer, which can be easily washed off after the work is completed. This procedure speeds up the work significantly and provides a better final result without unnecessary cleaning.

Figure 19. Example of how it can look when new materials are used. It becomes straight and perfect, and bricks with a thickness of 65 mm affect the expression.

Figure 20. A newly made crown with specially ordered bricks that are 58 mm thick can maintain proportions similar to the original. This thickness helps create a more authentic appearance and helps preserve the aesthetic balance. The overhang at the bottom allows the roof tiles to be placed correctly, preventing water from penetrating the structure without the need for metal cladding, which is often used in modern solutions.

The crown's casting is thin at the front, making it not very prominent, but the casting is thicker further in towards the middle. This is a deliberate solution to ensure structural durability without negatively affecting the visual impression. The casting has also taken into account the settlements that existed in the original construction. Therefore, it is very important to measure all details on the old chimney carefully if you choose to rebuild the crown, so that the original proportions can be recreated as closely as possible.

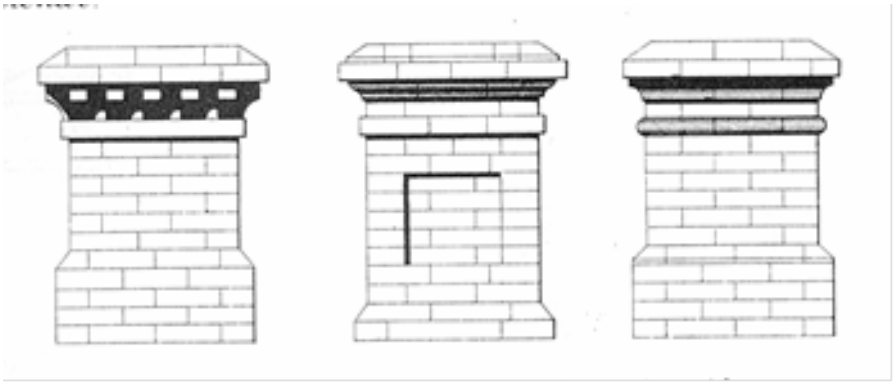

Figure 21. Image from Löwenskiöld's drawing example

In Löwenskiöld's drawings, you can see examples of how dimensions and shapes can be achieved with thinner bricks. These drawings are valuable as reference material to ensure that the correct proportions and details are preserved during a renovation or rebuilding of the crown. Using this type of drawing as a template helps maintain the historical integrity of the construction and provides a result that harmonizes with the building's original architecture.

Rebuilding a Chimney

If you choose to rebuild a chimney, be aware that today's building legislation and regulations will apply. For example, there are requirements for minimum height above the ridge according to Swedish building standards, which may mean that the new chimney does not look exactly like it did before. Therefore, it is always better to preserve the original appearance, as new regulations do not need to be applied to existing chimneys unless you choose to rebuild.

It is very important to maintain the chimney's original appearance, including how it was built, any tilt, and how flashing has been used. For example, there may be an overhang that should be preserved to avoid ruining the overall impression of the house. If it is not possible to exactly recreate the original design, at least try to create a chimney finish that is in harmony with the house's architecture.

Try to reuse the old bricks as much as possible if they are in good condition. Bricks from older chimneys are often mortared with lime or clay mortar, which is relatively easy to remove without damaging the bricks. Chimneys built before 1900 often have an overhang of 65 mm (1/4 brick), which means the top edge has an outward slope. This is an important detail to preserve to maintain the architectural expression.

When installing flashing on the chimney, keep it as simple as possible, as the chimney can otherwise easily get a too "metallic" appearance. The overhang should be at least 5 cm from the edge of the brick. In the past, slate or roof tiles were often used on the chimney crown before metal flashing became common.

However, in this description, it is recommended to use waterproof concrete (K60) with an embedded chimney cap, as shown in the attached images.

Figure 22. The image shows how the chimney can look when bricks that are 65 mm thick are used together with metal flashing on the overhang. This method helps maintain a traditional and correct aesthetic style while meeting modern building requirements.

What to Do When the Plaster on the Chimney Starts to Flake Off

Plaster on a chimney usually starts to flake off only if the chimney is plastered. Many older chimneys have exposed brick, and for these chimneys, the biggest risk is frost damage. This, however, only occurs if cement-based mortar is used, which is rarely done nowadays as we know that lime mortar is more suitable for older buildings.

If the plaster on your chimney starts to flake off, it may be because the chimney is not used regularly, allowing moisture to penetrate. When moisture gets under the plaster layer and the temperature drops below 0°C, frost damage can occur. To prevent this, it is important that the chimney has proper water protection. A

metal cap over the chimney can prevent water from penetrating and causing damage to the plaster.

For chimneys with larger flues, it may also be necessary to place a metal cap on top of the chimney. This helps prevent moisture from being drawn further down into the chimney, especially in the so-called soot flues, where moisture can otherwise cause damage.

Figure 23. The image shows a soot flue, which is an example of a chimney where a cap may be necessary to protect against moisture damage. By preventing moisture penetration, you can extend the life of the chimney and avoid costly repairs.

Figure 24. Here is an image of a newly made chimney with a cap that is a replica from the 1800s, but with some modernizations. In the original, riveted pillars were used, but here bolts have been used instead, which differs from the older construction technique. The chimney has not received the overhang that was common on older chimneys, and instead, a metal flashing has been used. This means that the original feel and aesthetics of the original chimney have not been fully recreated.

The bricks used for the chimney come from Horns Tegelbruk and have been made in a thinner variant than today's standard dimensions. This helps to preserve some of the older appearance and allows the chimney to still harmonize with the building's historical style, even though the metal flashing affects the visual impression compared to a traditional design with an overhang.

These types of details – the difference between using riveted pillars, overhangs, or metal flashing – can make a big difference in how close you come to the original feel and appearance. It shows the importance of careful planning and material selection to maintain a faithful restoration of historical buildings and chimneys.

Figure 25. The image shows a rebuild where the old bricks have been reused to rebuild the crown. At the base of the chimney, plaster has been chosen, creating a smaller overhang, and the overhang has then been fitted with a metal flashing for protection. The biggest deviation from the original is that legislation now requires a higher chimney, which has led to two extra courses of bricks being added on top. These new bricks have a different colour and firing, which differs from the reused bricks. Additionally, these new bricks have been mortared with a mortar that weathers over time.

The following images show the process of casting the chimney crown, which is designed to create updrafts and provide good suction, so that the smoke is not pushed down into the chimney. The casting is done with waterproof concrete of type K60, and the concrete should be earth-moist so that it can be shaped correctly and create the incline needed to optimize the chimney's function.

At the front edge of the crown, the thickness is only 3 cm, making it not very prominent, while the thickness near the cap is 12 cm. This provides stability and the correct slope, while the narrower front edge maintains an elegant and discreet appearance.

The cap used is so small that it is barely visible from the ground, contributing to an aesthetically pleasing result without compromising functionality. By using a small and efficient cap, the visual impact is minimized while effectively directing the smoke out, ensuring the entire construction retains its elegance and functionality.

Figure 26 and 27. The process of casting the chimney crown.

Figure 28. The image shows how a cap should not be designed, as well as an example of a thick crown casting that also contributes to problems. The cap shown does not provide good suction, which can cause the smoke to not be effectively led out of the chimney. This can lead to the smoke being pushed back into the chimney and into the house, which is a sign of poor ventilation and inadequate function.

What to Do When the Plaster on the Chimney Starts to Flake Off

Additionally, this chimney is built with cement-based mortar, which has resulted in frost damage. Cement-based mortar is not as flexible as traditional lime mortar and has a poorer ability to handle moisture and temperature changes, which can lead to damage such as frost damage in cold conditions. These damages not only affect the chimney's aesthetics but can also weaken the structure over time.

This image illustrates how incorrect design of both the cap and mortar material can cause serious problems both functionally and in terms of durability.

If the chimney has suffered frost damage, it is often decided to rebuild the entire structure. If this is necessary, you should carefully document the existing appearance before demolition. It is advisable to take photographs and make

measurements to ensure that the new chimney can be recreated as faithfully as possible. If the house has multiple chimneys, it is especially important that the new chimney matches the others in both colour and shape, to preserve the house's overall impression.

When choosing materials for the new chimney, consider using similar bricks to the original. Hard-fired masonry bricks or frost-resistant special bricks for chimney construction are recommended, as these materials are more resistant to frost damage. The choice of mortar is also crucial. In the 20th century, lime-cement mortar or pure cement mortar was often used, which is less effective at transporting moisture and less elastic than older types of lime mortar. This can lead to moisture being absorbed and causing frost damage.

To avoid these problems, you should instead use NHL 5 lime mortar when repairing and rebuilding the chimney. This traditional lime mortar is better at handling moisture and temperature variations, and helps ensure that the new chimney is both durable and aesthetically faithful to the original.

Chimneys Benefit from Continuous Use

A cap can extend the life of a chimney that is not used continuously.

Figure 29. The image shows a cap inspired by 19th-century style but adapted and technically modified by engineer Chico Crafoord to ensure safety, strength, and easy handling when the cap needs to be opened for cleaning. The construction

consists of two frames made of angle iron joined with hinges, allowing the cap to be folded up when needed.

The lower frame is embedded in the crown and has angle irons in the corners to reinforce the construction and provide a strong and stable anchoring. This ensures that the cap stays securely in place while being easy to open and handle when the chimney needs maintenance or cleaning. This cap is an example of how traditional aesthetics can be combined with modern technical improvements to create a solution that looks good and works practically in today's environment.

Figure 30. The image shows that the construction can be opened because there are hinges between the frames. Note the angle irons in the corners of the lower frame and the locking mechanism.

Figure 31. The cap is made of acid-resistant stainless steel, specially adapted to withstand harsh weather conditions in coastal environments. After manufacturing, the cap is painted black with linseed oil paint, mixed with lampblack to give it a traditional and aesthetically pleasing appearance. The construction of the locking mechanism is clearly visible in the image, showing its practical design to ensure the cap stays securely in place while being easy to open when needed.

Figure 32. The image also shows details of the angle iron in the corner, where a loop has been welded for use as a lifeline during maintenance work. This loop is placed in the part of the construction that will be cast into the chimney crown, providing a strong and stable anchoring for the cap. The mesh in the upper frame acts as a bird guard, preventing birds from nesting in the chimney, which is an important detail to ensure the chimney remains free of obstructions and functions optimally.

Figure 33 and 34. The images show a house from 1899 where the chimney has been repaired. Unfortunately, the rebuilding of the crown was done without documenting the type of stone, and thus the original tilt and the house's typical "king's crown" design were not preserved. Despite making an overhang to retain

some detail of the original construction, it has been covered with metal, altering the appearance and aesthetic feel compared to the original.

This is a clear example of how important documentation is when restoring historical buildings. By not following the original details carefully, such as the choice of stone, the specific design of the crown, and other details, much of the building's historical and architectural value can be lost. The overhang, which in this case has been covered with metal, diminishes the impression of authenticity and the traditional craftsmanship that characterized the house from the beginning.

Figure 35. Two houses from the same period, but with different solutions for chimney repairs.

The image above shows two houses from the same period, but with different solutions for chimney repairs. The middle chimney has been protected with a cap in good time, a cap similar to the one described earlier.

Thanks to this, the chimney has not deteriorated like the others. The nearest chimney in picture has been rebuilt, and the one in the back has received a poorly constructed cap and a new masonry crown.

It is clear that the cap has played a crucial role in preserving the middle chimney in its original condition. This highlights the importance of installing a cap on the chimney when you are already on the roof performing repairs.

A properly designed cap not only protects against weather and wind but also extends the chimney's lifespan by reducing the risk of moisture damage and frost damage.

Figure 36. The image shows a house where pipes have been installed in the chimney, resulting in a strangely thick top on the chimney. This modern solution not only negatively affects the appearance but also has practical consequences.

By installing pipes, the necessary radiant heat is prevented from escaping from the chimney, meaning the natural heat can no longer help dry out the house. This can lead to moisture problems in the building's structure, as the residual heat that previously spread via the chimney no longer reaches the attic or other parts of the house that need to be kept dry.

This change shows how modern interventions can negatively impact both aesthetics and functionality, especially in older houses where the original chimney design helped maintain a healthy indoor climate.

Figure 37. The image shows further examples of recently rebuilt crowns where the most common mistakes occur. The large cap covers a significant portion of the chimney, giving an unbalanced impression.

Additionally, there is no overhang at the bottom, which otherwise helps protect against rain and moisture intrusion. Instead, a large metal flashing has been used, which not only negatively affects the aesthetic expression but also risks losing functionality over time.

These mistakes lead to a chimney that not only looks inappropriate in relation to the house's architecture but may also be less effective in protecting against weather and wind. Proper proportions, a well-designed cap, and a traditional overhang are important to preserve both the chimney's function and the building's historical character.